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THE GENUS *ANTENNARIA* (ASTERACEAE: INULEAE) IN ARCTIC NORTH AMERICA: CHROMOSOME NUMBERS AND TAXONOMIC NOTES

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ABSTRACT

Chromosome numbers were determined from somatic material for 371 individuals representing 25 species of *Antennaria* from western and arctic North America. Most of the chromosome counts presented confirm previous reports for the respective taxa. Chromosome numbers are reported for specimens of *A. breitungii* ($2n = 56$), *A. ellyae* ($2n = 28$), *A. incarnata* ($2n = 56$) and *A. pedunculata* ($2n = 56$) collected from their respective type localities. Chromosome numbers are also reported for *A. pulcherrima* ($2n = 56$) and *A. rosea* ($2n = 70$) collected from their most northwestern stations in North America.

Key Words: *Antennaria,* chromosome numbers, northwestern North America

INTRODUCTION

Much of the literature regarding chromosome number determinations for North American species of *Antennaria* has been summarized by Bayer and Stebbins (1987). Subsequently, chromosome number determinations were obtained from additional populations from both western (Chinnappa, 1986; Chmielewski and Chinnappa, 1988a) and arctic (Chmielewski and Chinnappa, 1988b) North America. At least a single chromosome count is now available for most of the North American species of *Antennaria.* Exceptions to this statement include many of the eastern arctic taxa of unsettled rank, as well as the endemic species *A. soliceps* Blake. Only a few species of *Antennaria* (i.e., *A. microphylla* Rydb., *A. rosea* Greene, and *A. umbrinella* Rydb.) have been examined in sufficient cytological detail to warrant substantiated cytogeographic discussion. Since only one study to date has concentrated on the determination of chromosome number for arctic taxa (Chmielewski and Chinnappa, 1988b), the aim of the present investigation is to supplement available chromosome number determinations for these arctic taxa so that cytogeographic discussions will be possible in the future.

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MATERIALS AND METHODS

The methodology used here relative to cultivation and maintenance of specimens, as well as pretreatment of material for chromosome number determinations, has been described previously (Chinnappa and Chmielewski, 1987). Most of the major species groups in *Antennaria* from western arctic North America are problematic and warrant detailed systematic attention. Each of the major floras of the western arctic region (Anderson, 1959; Hultén, 1968; Welsh, 1974; Porsild and Cody, 1980) exhibits a particular bias in its respective taxonomic approach. Both Hultén (1968) and Welsh (1974) tended to lump species together into general groups while Anderson (1959) and Porsild and Cody (1980) tended to split these general groups into numerous species. In our study we did not accept either approach in its entirety, but used the available floras as a basis for specimen identification. Chromosome numbers are therefore reported separately for taxa which may ultimately be shown to be little more than minor variants in more diverse species complexes. The utilization of this approach was not intended to reflect support for recognition of these variants but is rather to serve as an informative aid to those investigators presently involved in revisions of these species complexes. A similar approach was adopted by Chmielewski and Chinnappa (1988b). The treatments of Chmielewski and Chinnappa (1988c) and Chmielewski et al. (1990a, 1990b) were followed for previously revised species complexes. All vouchers were collected by the authors and subsequently deposited at UAC.

RESULTS AND DISCUSSION

Chromosome numbers were determined for 371 individuals representing 25 species (Table 1). Because species identification for arctic taxa is often based on the presence or absence of staminate plants in a population, chromosome numbers are reported separately for staminate and pistillate clones. Of the 25 species examined, 6 were represented by at least one population for which chromosome numbers were reported for both pistillate and staminate individuals. Most chromosome numbers reported for the respective species support previous determinations; thus they are presented without comment. Several groups of taxa remain problematic and as such warrant thorough systematic attention.

Table 1. Chromosome number determinations for 25 species of western North America *Antennaria* collected predominantly from north of the 60th parallel. Listed are species, chromosome number, location (KP = kilometre post, MP = milepost), and collection number. Staminate individuals are designated with an asterisk (*) following the collection number. A single hermaphroditic individual is designated with a double asterisk (**).

A. alborosea Porsild $2n = 56$. **Alaska**: Richardson Hwy.: 7 km N of Little Tonsina State Recreational Area, *3991*; MP 63, N of Chugach Mtns., N of Valdez, *3994*. Edgerton Hwy. to Chitina, 1.5 km E of Richardson Hwy. to Valdez, *4059*. **British Columbia**: Cassiar Hwy.: 10 km N of Cassiar, *4723*; Cassiar turnoff, 7 km W of Cassiar Hwy., *4724, 4725*; 12 km N of Iskut, just N of Tsasbye Creek, *4749A*. **Yukon**: Alaska Hwy.: 42 km W of Watson Lake, *3868*; 76 km W of Watson Lake, *3871*.

A. angustata Greene $2n = 56$. **Alberta**: Banff National Park: Parker Ridge Trail, *4885*; Sunshine Ski Resort Meadows, *4901, 4902, 4903*; Jasper National Park, just below summit of Mt. Edith Cavell Trail, *4892, 4893, 4894, 4895*. **British Columbia**: Haines Hwy., Three Guardsmen Pass, base of Three Guardsmen Mtn., KP 162.5, *3944*.

A. atriceps Fern. $2n = 56$. **British Columbia**: Haines Hwy.: Chilkat Pass, Nadahini Mtn., KP 147.7, *3957*; Stanley Creek, S of Yukon border, *3969, 3970*.

A. breitungii Porsild $2n = 56$. **British Columbia**: 7 km NE of Telegraph Creek, *4741*. **Yukon**: Klondike Loop 2, N of Carcross, S of Whitehorse, Lewes Lake, KP 136.3, (type locality) *3895, 3896, 3897, 3898, 3899*.

A. compacta Malte $2n = 56$. **Alberta**: Banff National Park, Peyto Lake Trail, *4879*. **British Columbia**: Haines Hwy.: S of Chilkat Pass, Mount McDonell, just S of Seltat Creek, KP 177.3, *3919*; Three Guardsmen Pass, base of Three Guardsmen Mtn., KP 162.5, *3947*.

A. densifolia Porsild $2n = 28$. **Yukon**: Dempster Hwy.: KP 131, N of Tombstone Mtn. Campground, *4519, 4520**; southern end of Windy Pass, KP 153.5, *4525, 4526**; northern end of Windy Pass, KP 177, S of Engineer Creek, *4535, 4536**; Windy Pass, KP 158.8, *4538**; Windy Pass, KP 157.9, *4540*, 4541*; S of Windy Pass, KP 130, *4544*, 4545, 4548*, 4549*.

A. elegans Porsild $2n = 28$. **Yukon**: South Canol Rd., just N of Bacon Creek, KP 179.5, *4669*.

$2n = 56$. **Alaska**: Richardson Hwy., 7 km N of Little Tonsina State Recreational Area, MP 68.5, *3993*. Edgerton Hwy.: to Chitina, 1.6 km E of Richardson Hwy. to Valdez, *4060*; 11.2 km N of Chitina, MP 25–26, *4067*. Old Edgerton Loop Rd., 13 km SE of intersection with Richardson Hwy., *4081*. Glenn Hwy., MP 181.1, Sheep Mtn. access rd., *4129*. Taylor Hwy., MP 16.5, NE of Tok, *4475*. **Alberta**: Hwy. 2, Huallen Rd., NW of Grande Prairie, *3761*. **British Columbia**: Alaska Hwy., N of Rancheria Falls, KP 1215.5, *3877*. Cassiar Hwy.: 6 km N of Boya Lake Provincial Park, *4721*; Telegraph Creek Rd., 5 km S of Dease Lake, *4730*; 12 km N of Iskut, *4749B*; 9 km N of Kinasken Lake Campground, *4757*. **Yukon**: Alaska Hwy.: 40 km W of Watson Lake, KP 1061.5, *3866*; 76 km W of Watson Lake, KP 1097.5, *3872*; Klondike Loop 2, Lewes Lake N of Carcross, KP 136.3, *3901*. Campbell Hwy., just N of turnoff to Frenchman Lake Campground, KP 552, *4607*; 10 km SE of Faro, KP 410, *4613*. South Canol Rd.: 2 km S of Lapie River crossing No.

Table 1. Continued.

2, KP 211.6, *4664*; KP 191.3, *4667*; Gold Creek, KP 177, *4670*; Teslin-Nisutlin Pass, KP 12.5, *4706*.

A. ellyae Porsild $2n = 28$. **Yukon**: Dempster Hwy.: Blackstone River, KP 131, *4521* (type locality); northern end of Windy Pass, KP 177, S of Engineer Creek Campground, *4537*.

A. friesiana (Trautv.) Ekman $2n = 28$. **Alaska**: Chena Hot Springs Rd., Chena Dome Trail, MP 49.1, NE of Fairbanks, *4237**, *4238*, *4240*; Manley Hot Springs Rd., MP 93.5, *4261**, *4262*. Dalton Hwy.: Department of Transportation Checkpoint, Chandalar Shelf, MP 237.1, *4295**, *4296A*, *4302*, *4303**; crossing No. 1, S of Atigun River, MP 253, *4340**, *4341*; 3.6 km N of Toolik Lake, MP 286, *4352**, *4353*; 3.6 km S of Pump Station No. 2, MP 357, *4405**; 8 km S of the Arctic Circle, MP 110–109, *4424**, *4425*, *4426**, *4427*; turnoff at Olsen's Lake and Kanuti Flats, just N of Finger Mtns., MP 98.2, *4428**, *4429*, *4430*. Steese Hwy.: Twleve Mile Summit, 0.8 km W of turnoff, MP 85.6, *4439**, *4440*; 1 km E of turnoff on Robert Pinnell Trail, *4444**, *4445*; Eagle Summit, 0.8 km E on Robert Pinnell Trail, *4451**, *4454*, *4455*, *4456**, *4457*, *4458**, *4459**. Taylor Hwy., turnout at top of summit, MP 143.3, *4491*.

$2n = 56$. **Alaska**: Dalton Hwy.: Department of Transportation Checkpoint, Chandalar Shelf, Brooks Range, MP 237.1, *4297*, *4301*; 3 km N of Island Lake, MP 278, *4347**, *4348*; 3.2 km N of Toolik Lake, MP 286, northern Brooks Range, *4351*, *4354*; 8 km S of Pump Station No. 2, MP 354, *4368*; 3.6 km S of Pump Station No. 2, MP 357, *4406*; 6.4 km N of Sagwon airstrip, MP 352, *4416*, *4417*. **Yukon**: Top of the World Hwy., just E of CAN–USA border, *4495*, *4498*, *4499*. Dempster Hwy.: 2 km N of Tombstone Campground, KP 74, *4506*; KP 107–108, beside Blackstone River, *4507*; southern end of Windy Pass, KP 130, *4550*.

$2n = 70$. **Alaska**: Richardson Hwy.: 7.7 km N of McCallum Creek, 35 km N of Paxson, *4083*; 3.7 km N of McCallum Creek, 31 km N of Paxson, *4089*; McCallum Creek, 27 km N of Paxson, *4090*; top of Chandalar Shelf, Department of Transportation Checkpoint, Brooks Range, MP 237.1, *4299*; 7.2 km N of Pump Station No. 3, MP 316, *4356*; 12.9 km N of Pump Station No. 3, Kakuktukruich Bluff, MP 320, *4358*; 11.2 km S of Pump Station No. 2, MP 352, *4363*, *4364*; 8 km S of Pump Station No. 2, MP 354, *4367*, *4370*; 6.4 km N of Sagwon airstrip, MP 352, *4418*.

A. incarnata Porsild $2n = 56$. **Yukon**: South Canol Rd., jctn. of Sheep Creek and Rose River, KP 153 (type locality), *4688*.

A. isolepis Greene $2n = 56$. **Alaska**: Richardson Hwy., 7 km N of Little Tonsina State Recreational Area, MP 68.5, *3992*. Glenn Hwy.: 6 km E of Little Nelchina River bridge, KP 227, *4109*; 5 km E of Eureka Summit, *4113*; just W of Eureka Summit, E of Tahneta Pass, *4125*; Sheep Mtn. access rd., KP 181.1, *4130*. Kenai Peninsula, jctn. of Shilak Lake Loop Rd. and Sterling Hwy., *4207*, *4208*. Shilak Lake Loop Rd., 12 km E of access rd. to Bottinentnin Lake, *4210*. George Parks Hwy.: Wilderness Rim Rd., N of Willow, MP 80, *4224*; southern part of ascent to Broad Pass, MP 97, *4227*. Taylor Hwy., MP 22.5, NE of Tok, *4477*. **British Columbia**: Haines Hwy.: Three Guardsmen Pass, base of Three Guardsmen Mtn., KP 162.5, *3946*; Chilkat Pass, Nadahini

Table 1. Continued.

Mtn., *3956*. Cassiar Hwy., 12 km N of Iskut, *4750*. **Northwest Territories**: North Canol Rd., 1.7 km N of Yukon border, *4653, 4655*. **Yukon**: Dempster Hwy., KP 40, *4503*. North Canol Rd.: just N of Mt. Sheldon, KP 363, *4625*; 1 km N of MacMillan River crossing, KP 414, *4639*; N of Dewhurst Creek, KP 430.5 *4643*; MacMillan Pass, MacKenzie Mtns., Backbone Range, KP 220, *4646*. South Canol Rd.: just S of Gold Creek, KP 177.2, *4675*; Lapie Lake access rd., *4678*; 1 km N of Groundhog Creek, *4681*; Rose River crossing No. 6, KP 155.1, *4684*.

A. lanata (Hook.) Greene $2n = 28$. **Alberta**: Banff National Park, summit of Parker Ridge, *4886*, 4887*.

A. media Greene $2n = 56$. **Alberta**: Banff National Park, summit of Parker Ridge Trail, *4884*. Jasper National Park, just below summit of Mt. Edith Cavell Trail, *4891*.

A. microphylla Rydb. $2n = 28$. **Alberta**: Ghost River Valley, *4907, 4908**. **British Columbia**: BC95, 2 km N of Edgermount, 12 km N of Radium, *4897*, 4898*.

A. monocephala DC. $2n = 28$. **Alaska**: Richardson Hwy.: Worthington Glacier, access rd. to recreational area, *4006*, 4007*; Thompson Pass, N of Valdez, just S of Blueberry Lake Recreational Area, *4039*, 4040, 4041*, 4042*; 4.8 km N of Thompson Pass, *4046*, 4047*; summit of Thompson Pass, *4050*, 4051, 4052*. Denali Hwy.: 1.5 km W of Paxson, *4094*; 5.6 km W of Paxson, *4095*, 4096*. Glenn Hwy., Eureka Summit, KP 208.1, *4116*, 4117, 4118**. Fishhook-Willow Rd., Hatcher Pass, NW of Palmer, *4140*, 4141*. Seward Hwy., Mount Alyeska, *4158*, 4159, 4160***. George Parks Hwy., southern end of ascent to Broad Pass, MP 97, *4226*. Steese Hwy.: 1.6 km E of turnoff on Robert Pinnell Trail, *4446, 4447, 4448*, 4449*; Eagle Summit, Robert Pinnell Trail, *4460*, 4461*, 4462*, 4463*, 4464, 4465*. **British Columbia**: Haines Hwy.: Three Guardsmen Pass, base of Three Guardsmen Mtn., KP 162.5, *3938*, 3939, 3940*, 3941, 3942*, 3943**; Stanley Creek, S of Yukon border, *3965*, 3966, 3967*, 3968*. **Yukon**: Nahanni Range Rd.: 32 km NE of Cantung Junction, Long Lake access rd., *3806*, 3807*; 90 km NE of Cantung Junction, between Moose Creek and Flood Creek, 10 km S of Flood Creek, *3822*, 3823*. Dempster Hwy., Tombstone Campground, nature trail W of campground, *4553*, 4554, 4555*. Silver Trail Hwy., Keno Hill Summit, Keno City, *4568*, 4569, 4570*. North Canol Rd., MacMillan Pass, S of roadpost 454, Mackenzie Mtns., Backbone Range, *4647*.

A. neodioica Greene $2n = 84$. **British Columbia**: Alaska Hwy., S of Tritch, KP 282, *3766*.

$2n = 112$. **Alberta**: Hwy. 43, 36 km NW of Whitecourt, *3754, 3755*. **British Columbia**: Pink Mtn. access road, 1 km W of Mae's kitchen, *3763*. Alaska Hwy., 15 km NW of Fireside, KP 897, *3787*. Cassiar Hwy., 9 km N of Kinasken Lake Campground, KP 379, *4754*. **Yukon**: Alaska Hwy., NE of Lower Post, KP 982, *3789*.

A. oxyphylla Greene $2n = 56$. **Alaska**: Elliott Hwy., MP 123.5, Manley Hot Springs Rd., *4279*; 16 km NE of Manley Hot Springs, *4282*. Dalton Hwy., N of Yukon River, hill marked 'Roller Coaster,' *4287*. Alaska Hwy., 6.5 km NW of Dot Lake, KP 1367.5, *4469*. Taylor Hwy., NE of Tok, KP 36.2, *4476*. **Yukon**: Klondike Loop, 5 km S of Pelly Crossing, KP 460, *4599*.

Table 1. Continued.

A. pallida Nelson $2n = 56$. **Alaska**: Richardson Hwy., Worthington Glacier, MP 28.7, *4008*. Valdez, 3.2 km along bay rd. from Alyeska Ferry terminal, *4027*. Edgerton Hwy. to Chitina, 1.6 km E of Richardson Hwy. to Valdez, *4061*. Denali Hwy.: 1.5 km W of Paxson, *4092*; 13.7 km W of Paxson, *4099*. Glenn Hwy., Eureka Summit, KP 208.1, *4119, 4120*. Mount Alyeska off of Seward Hwy., *4161*. George Parks Hwy., middle fork of Chulitna River, S of Broad Pass, MP 194.5, *4225*. **Alberta**: Jasper National Park, just below summit of Mt. Edith Cavell Trail, *4890*. **British Columbia**: Alaska Hwy., 2 km N of Strawberry Flats Campground, Muncho Lake, *3779*. **Yukon**: Nahanni Range Rd.: between North Moose Creek and Flood Creek, 10 km SW of Flood Creek, KP 89, *3819*; N of emergency airstrip, S of Ostensibility Creek, KP 119, *3830*.

A. pedunculata Porsild $2n = 56$. **Alaska**: Seward Hwy., Kenai Peninsula, just N of Hope access rd. turnoff, *4183*. Kalifornsky Beach Rd., just N of Kasilof, 19.3 km S of Soldotna, *4214*. Elliott Hwy., 6.4 km NE of Manley Hot Springs, MP 148, *4283*. Taylor Hwy., MP 15, NE of Tok, *4473, 4474*. **British Columbia:** Cassiar Hwy., 9 km N of Kinasken Lake Campground, KP 379, *4755*. **Northwest Territories**: North Canol Rd., 1.7 km N of Yukon border, *4654*. **Yukon**: Dempster Hwy.: Blackstone River area, KP 107.5 *4513*; Tombstone Campground nature trail, *4552*. North Canol Rd.: 0.5 km N of MacMillan River crossing No. 5, *4651, 4652*; N of Mt. Sheldon, KP 363, *4626*. South Canol Rd.: Rose River crossing No. 6, KP 155.1, (type locality), *4683, 4685*; jctn. of Sheep Creek and Rose River, KP 153, *4689*.

$2n = 70$. **Yukon**: North Canol Rd., N of MacKenzie River crossing No. 4, 0.7 km S of MacMillan River crossing No. 5, KP 459.6, *4650*.

A. pulcherrima (Hook.) Greene $2n = 56$. **Alaska**: Dalton Hwy.: 19.6 km N of Coldfoot, *4288*, 4289*; N of Coldfoot, Middle Fork Koyukuk River, bridge No. 1, *4293*, 4294*. **British Columbia**: Cassiar Hwy., 42 km N of Good Hope Lake, *4716**. **Yukon**: South Canol Rd.: jctn. of Sheep Creek and Rose River, KP 153, *4686*, 4687*; 1.5 km N of Rose River crossing No. 4, KP 145.8, *4692*, 4693*; just N of Rose River crossing No. 3, KP 144–143, *4695*, 4696*.

A. rosea Greene $2n = 56$. **Alaska**: Richardson Hwy.: just S of Tonsina River crossing, between Glenallen and Valdez, *3988*; N of Chugach Mtns., N of Valdez, just S of Tonsina State Recreational Area, *3995, 3996, 3997*. Glenn Hwy.: 1 km E of Tolsona Lake Rd., W of Tolsona Creek, *4101*; 10 km E of Tolsona Lake Rd., *4103*; 5 km E of Eureka Summit, *4112*; Sheep Mtn. access rd., KP 181.1, *4128*; E of Long Lake, KP 137.3, *4132*. Sterling Hwy., Kenai Peninsula, Shilak Lake Loop Rd., 1 km E of turnoff to Shilak Lake, *4206*. Elliott Hwy.: 4.8 km W of jctn. with Dalton Hwy., MP 77, *4257*; just SW of Baker Creek, MP 138, *4280*. Taylor Hwy., NE of Tok, MP 15, *4472*. **Alberta**: Hwy. 43, 2–3 km W of Valleyview, *3758*. Hwy. 2: W city limit sign for Grande Prairie, *3759, 3760*; Huallen Rd., NW of Grande Prairie, *3762*. **British Columbia**: Pink Mtn. access rd., 1 km W of Mae's Kitchen, *3764*. Alaska Hwy.: 21 km SE of Fireside, NW of Liard Hot Spring, *3782*; 10 km SE of Fireside, *3786*. Cassiar Hwy.: BC–Yukon border, KP 729.8, *4708*; 53 km N of Good Hope Lake, *4712*; 40 km N of Good Hope Lake, *4718*; 10 km N of jctn. to Cassiar, *4722*. Telegraph Creek Rd.: 5.5 km S of Dease Lake,

Table 1. Continued.

4732; 27 km S of Dease Lake, 1 km N of Auguste Childe Creek, *4734*; 17 km NE of Telegraph Creek, *4743, 4744*. Cassiar Hwy.: 24 km N of Iskut, *4748*; 12 km N of Iskut, *4751*; 9 km N of Kinasken, KP 379, *4756*. **Yukon**: NE of Lower Post, Hyland River crossing, *3790*. Nahanni Range Rd.: 4 km NE of Cantung Junction, *3792*; just N of North Bridge Creek, *3815, 3816*; between North Moose Creek and Flood Creek, KP 90, 10 km SW of Flood Creek, *3817*; N of emergency airstrip, S of Ostensibility Creek, KP 119, *3832*; between Ostensibility Creek and Piggott Creek, KP 125, *3843*. Alaska Hwy.: 40 km W of Watson Lake, KP 1061.5, *3865*; 42 km W of Watson Lake, KP 1063.5, *3867, 3869*; 76 km W of Watson Lake, *3870*; just N of Rancheria, *3874, 3875*. Klondike Loop 2, N of Carcross, Lewes Lake, *3894, 3900*. Haines Hwy., Kluane National Park, Auriel Trail, N of Kathleen Lake, *3913, 3914*. Top of the World Hwy., E of CAN–USA international border, KP 74–75, *4500*. Dempster Hwy.: KP 40, *4502, 4504*; Blackstone River, KP 109–110, *4515*; KP 12.2, *4562*. Silver Trail Hwy.: 1 km SW of jctn. to Minto Lake, KP 68, *4565, 4566*; Halfway Lakes, KP 77, *4567*. Just SW of jctn. of Duncan Creek Rd. and Silver Trail Hwy., SW of Keno City, *4595*. Duncan Creek Rd., 15 km NE of jctn. with Silver Trail Hwy., SW of Keno City, *4596*. Klondike Loop: between Mayo and Pelly Crossing, 20 km S of jctn. to Ethel Lake, KP 315, *4597*; 2 km N of MacGregor Creek, KP 406–407, *4603*. Campbell Hwy.: 21 km SE of Carmacks, KP 570, *4605*; 45 km NW of Faro, KP 465, *4612*. North Canol Rd.: Marjorie Lake area, *4615*; between Gravel Creek and Flat Creek, KP 281.3 *4618*; 2 km NE of Flood Creek, KP 308, *4619*; 3 km N of Dragon Lake, KP 338, *4621*; S of Itsi Range, KP 394, *4634, 4635, 4636*. South Canol Rd.: just S of Campbell Hwy., *4662*; S of Lapie River crossing No. 2, KP 191.3, *4666*; just S of Gold Creek, KP 177.2, *4671, 4672, 4673, 4674*; just N of Rose River crossing No. 3, KP 144–143, *4694*; N of Gravel Creek, KP 137.7, *4697, 4699*; 2 km N of Gravel Creek, KP 123.5, *4700*; just N of KP 112, *4701*; end of access rd. to Nisutlin River, KP 67.6, *4702, 4703*; Teslin-Nisutlin Pass, KP 12.5, *4705, 4707*.

$2n = 70$. **Alaska**: Richardson Hwy., 7 km N of Little Tonsina State Recreational Area, MP 68–69, *3990*. Elliott Hwy., 4.8 km W of jctn. with Dalton Hwy., MP 77, *4259*. Dalton Hwy., 16 km N of Yukon River Crossing, MP 66, *4286*. **Yukon**: North Canol Rd., N of Mt. Sheldon, KP 371, *4628*.

A. sedoides Greene $2n = 84$. **Alberta**: Banff National Park, summit of Parker Ridge Trail, *4880*.

A. stolonifera Porsild $2n = 56$. **Alaska**: 1 km SE of East Ave., SE of jctn. of Old Sterling Hwy. and Sterling Hwy., SE of Anchorage Pt., Kenai Peninsula, *4217*. **British Columbia**: Alaska Hwy., S of Tritch, KP 282, *3767*. **Yukon**: Nahanni Range Rd.: 32 km NE of jctn. with Campbell Hwy., Long Lake access rd., KP 32.7, *3804, 3805*; between North Moose Creek and Flood Creek, 10 km SW of Flood Creek, S of KP 89, *3818, 3820, 3821*; between Ostensibility Creek and Piggott Creek, KP 125, *3841*; 3 km NE of end of maintained section of road, KP 135, *3854*.

A. straminea Fern. $2n = 56$. **Alaska**: Glenn Hwy.: 6 km E of Little Nelchina River bridge, KP 227, *4110*; Eureka Summit, just W of summit, E of Tahneta Pass, *4124*. Kenai Peninsula, jctn. of Shilak Lake Loop Rd. and Sterling Hwy., *4205*.

Table 1. Continued.

A. umbrinella Rydb. $2n = 56$. **British Columbia**: Cassiar Hwy., S of Dease Lake, beside Day's Ranch, KP 88.5, *4737*. Telegraph Creek Rd., 7 km NE of Telegraph Creek, *4740*.

Monocephalous Taxa—The *Antennaria monocephala* DC. Complex

This problematic group consists minimally of the monocephalous *Antennaria angustata* Greene, *A. monocephala* DC., *A. philonipha* Porsild, and *A. pygmaea* Fern. In North America, staminate specimens of these species (*A. monocephala* and *A. philonipha*) were consistently reported to be diploid (Chmielewski and Chinnappa, 1988b), whereas pistillate specimens were reported to be either diploid, triploid, pentaploid, or heptaploid (Packer and McPherson, 1974; Bayer and Stebbins, 1987; Chmielewski and Chinnappa, 1988a, 1988b). Polyploidy and the apparently associated shift from sexual reproduction to agamospermy are the two most likely factors that have contributed to morphological variation and related taxonomic confusion among these taxa; these evolutionary relationships are presently under investigation.

In previous taxonomic keys to these taxa, gender was considered to be a diagnostic character (Hultén, 1968; Porsild and Cody, 1980). However, gender ratios within a population, or an individual's gender *per se*, should have no bearing on its identification. Based on our preliminary results obtained from gender-independent morphometric analysis of quantitative characters, the monocephalous arctic *Antennaria* are treated as two taxa (Chmielewski and Chinnappa, unpubl.). Final decisions regarding the rank of these taxa await completion of examination of associated type material. The two taxa are treated herein at the specific rank (*A. angustata* and *A. monocephala*). Although similar in gross morphology, the two taxa differ in that the adaxial surface of both basal and cauline leaves in the former taxon is grey tomentose, whereas in the latter taxon, the surface is glabrous-strigose.

Pleiocephalous Taxa—The *Antennaria friesiana* (Trautv.) Ekman Complex

The problematic pleiocephalous taxa may be caespitose or stoloniferous. The caespitose taxa may be further subdivided into

those taxa in which the basal leaves are petiolated, lanceolate, spatulate, or spatulate-lanceolate, and those taxa in which the basal leaves are short, densely crowded, obovate to oblanceolate or obtuse. The first group of problematic pleiocephalous caespitose taxa consists of *Antennaria alaskana* Malte, *A. ekmaniana* Porsild, *A. friesiana* (Trautv.) Ekman, *A. neoalaskana* Porsild and *A. subcanescens* Ostf.—those taxa in which the basal leaves are petiolated, lanceolate, spatulate, or spatulate-lanceolate. Although a distinction was made between some of these taxa in previous studies dealing with chromosome number determinations (Johnson and Packer, 1968; Bayer and Stebbins, 1987; Chmielewski and Chinnappa, 1988b), we consider it prudent for the time being to include all specimens fitting these species descriptions under *A. friesiana s.l.* Based on a relatively small sample of arctic specimens, we previously believed that it was possible to separate these taxa on involucre size, achene characteristics and style length (Chmielewski and Chinnappa, 1988b). However, once a sufficiently large sample of specimens was examined, it became obvious that taxa once considered to be distinct represented end points of a morphological continuum. As with the monocephalous taxa, polyploidy (Table 1) and an associated shift from sexual reproduction to agamospermy are factors most likely responsible for taxonomic confusion in these taxa. Detailed evolutionary studies to determine associations among these taxa are presently underway.

In previously reported work (Chmielewski and Chinnappa, 1988b), we apparently misunderstood *A. crymophila* Porsild and erroneously reported diploid, tetraploid and pentaploid chromosome number determinations for seven individuals from arctic North America. These individuals are more appropriately treated as *A. friesiana s.l.*, and are so included here.

Pleiocephalous taxa—The *Antennaria media* Greene Agamic Complex

The second group of problematic pleiocephalous, caespitose taxa consists of *Antennaria compacta* Malte, *A. densifolia* Porsild and *A. ellyae* Porsild—those taxa in which the basal leaves are short, densely crowded, obovate to oblanceolate, or obtuse. Although the status of *A. compacta* is unsettled at present (Hultén, 1968; Welsh, 1968, 1974; Scoggan, 1979; Porsild and Cody, 1980),

there is little doubt that the taxon belongs in the *A. media* agamic complex. The three tetraploid counts listed for *A. compacta* (Table 1) support previous determinations for *A. media* (Bayer, 1984).

The diploid chromosome number listed in Table 1 for populations of *Antennaria densifolia* support previous determinations for this taxon from arctic North America (Chmielewski and Chinnappa, 1988b). Based on measurements of pollen grains and guard cells, Bayer (1989a) reported that a disjunct population of *A. densifolia* collected from Montana was also probably diploid.

Except for minor differences in plant height and stolon characteristics, specimens of *Antennaria ellyae* collected from the type locality were similar to *A. densifolia.* These diploid specimens were collected from beneath shrubs or in hollows which were either shadier or wetter than the surrounding exposed calcareous soils from which "typical" *A. densifolia* was collected. Morphological differences between the two taxa apparently reflect environmentally induced variation. Thus, although we consider *A. ellyae* to be synonymous with *A. densifolia,* the relationship between *A. compacta* and *A. densifolia* is under study.

Antennaria atriceps Fern., *A. pallida* Nelson, and *A. stolonifera* Porsild represent three stoloniferous, pleiocephalous taxa of unsettled rank (Porsild, 1950; Hultén, 1968; Welsh, 1968, 1974; Scoggan, 1979; Porsild and Cody, 1980), which, like *A. compacta,* belong to the *A. media* agamic complex. Additional studies are necessary to delimit evolutionary relationships among these taxa here included in the *A. media* agamic complex.

Antennaria pedunculata and *A. isolepis* remain as problematic taxa. Generally, *A. pedunculata* is most similar to *A. isolepis,* differing from the latter by its long-pedunculate lateral heads. The species is, however, similar to *A. isolepis* with respect to its broad, pale inner phyllaries. Although the involucres of *A. isolepis* are obviously pedunculate, the peduncles are generally less than two cm long and the lateral involucres do not overtop the central involucre. When lateral involucres overtop the central involucre, specimens of *A. isolepis* intergrade with *A. pedunculata.* Conversely, when peduncles are short and the inflorescence is compact, *A. isolepis* intergrades with *A. pallida.* A fourth taxon of unsettled rank associated with these species is *A. rousseaui* Porsild. We disagree with the placement of *A. isolepis* in synonymy with *A. rosea* subsp. *pulvinata* (Greene) R. Bayer (Bayer, 1989b) with the simultaneous exclusion of *A. pallida, A. pedunculata,*

and *A. rousseaui.* When a sufficiently large number of specimens is examined, a morphological continuum is apparent. As such, *A. isolepis, A. pallida, A. pedunculata* and *A. rousseaui* should not be dealt with independently. It is the opinion of the present authors that these species are more appropriately treated in the *A. media* agamic complex.

Miscellaneous Complexes

In addition to supporting and supplementing previous information on chromosome distribution in *A. pulcherrima* (Urbanska, 1983; Chinnappa, 1986; Bayer and Stebbins, 1987; Chmielewski and Chinnappa, 1988b), the present study lists tetraploid counts for pistillate and staminate individuals from the most northwestern known station for the species (Table 1).

Antennaria rosea was previously reported as diploid, triploid, tetraploid, and pentaploid (Bayer and Stebbins, 1981, 1987; Morton, 1981; Bayer, 1984; Chinnappa, 1984, 1986; Chmielewski and Chinnappa, 1988a, 1988b). The tetraploid and pentaploid chromosome number determinations presented for *Antennaria rosea* (Table 1) extend our previous knowledge of chromosome distribution for the taxon throughout the western arctic. Specimens examined from northern British Columbia fill a previous gap in our knowledge relative to the cytogeography of the species in this area. *Antennaria rosea* is predominantly tetraploid, but pentaploid individuals occur sporadically throughout its range (Chmielewski and Chinnappa, 1988c). A collection from the most northwestern station known for the species was pentaploid.

Three specimens could not be satisfactorily assigned to any of the western arctic species utilizing keys published by Porsild (1950), Anderson (1959), Hultén (1968), Welsh (1974), or Porsild and Cody (1980). Although they are similar to a paratype of *A. elegans* collected from the south end of Kluane Lake, Yukon (CAN *105589*), this specimen is not typical of that species. These three specimens more closely resemble the type of *A. straminea* Fern., a species considered to be endemic to Newfoundland, and are therefore reported under that name. The status of these collections, as well as of this species, warrant further investigation.

A sufficient number of chromosome counts is now available for most western arctic species of *Antennaria* to determine which cytotype is the more common in a species group. Chromosome

number determinations are lacking for eastern arctic species of *Antennaria*. Future cytological studies should deal predominantly with the eastern arctic and high arctic taxa. All the taxa of arctic North America warrant exhaustive morphological investigation. We are presently investigating both the *A. friesiana* and *A. monocephala* species complexes.

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